

## PATENT ABSTRACTS OF JAPAN

1026

(11)Publication number : 06-210633

(43)Date of publication of application : 02.08.1994

(51)Int.Cl.

B29B 17/00  
B29B 13/02  
B29C 35/08  
// B29K 21:00  
B29K105:26

cl. 1, 3, 4

(21)Application number : 05-023462

(71)Applicant : MICRO DENSHI KK

(22)Date of filing : 20.01.1993

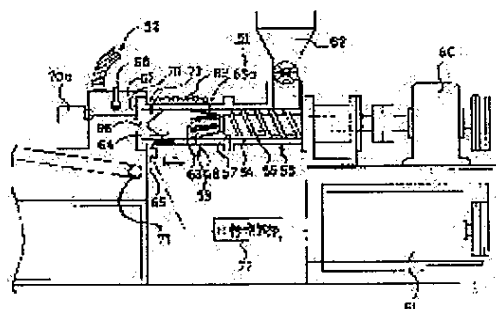
(72)Inventor : MURAYAMA TERUO  
MINOBE TOMIO

## (54) RECLAMING DEVICE FOR WASTE VULCANIZED RUBBER

## (57)Abstract:

PURPOSE: To obtain the title device heating ground waste vulcanized rubber to desulfurization temp. by a mechanical heating means to depolymerize the same.

CONSTITUTION: The shearing heating part 59 provided to a mechanical heating means 51 heats ground waste from the outside thereof by a high frequency induction heating means 69 and the charged ground waste vulcanized rubber is heated to desulfurization temp. in the shearing heating part 59 by mechanical heating and induction heating to be depolymerized.



## LEGAL STATUS

[Date of request for examination] 08.12.1999

[Date of sending the examiner's decision of rejection] 27.02.2001

[Kind of final disposal of application other than

the examiner's decision of rejection or  
application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's  
decision of rejection]

[Date of requesting appeal against examiner's  
decision of rejection]

[Date of extinction of right]

Copyright (C); 1998,2003 Japan Patent Office

## \* NOTICES \*

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

DETAILED DESCRIPTION

---

[Detailed Description of the Invention]

[0001]

[Industrial Application] About the regenerative apparatus of abandonment vulcanized rubber, this invention equips the mechanical exoergic means of a screw extruder with heating meanses, such as high-frequency induction heating, and relates to the equipment which heats vulcanized rubber to desulfurization temperature and is reproduced.

[0002]

[Description of the Prior Art] An example of the regenerative apparatus in conventional abandonment vulcanized rubber is shown in drawing 4. After sorting out the kind of abandonment vulcanized rubber in a raw material 11 in the sorting process 12, in the trituration process 13, with a grinder, it is made powdered, and a rubber processing oil or a regenerant is added, mixed and prepared if needed in the preparation mixture process 14 to the powder vulcanized rubber. In addition, the rubber which does not need this process is directly supplied to the microwave heating process 15 with powder.

[0003] And in the microwave heating process 15, powder vulcanized rubber is made to desulfurize and it considers as a partial-solution polymerization state. Combustion formula deodorization equipment 16 is connected to this microwave heating process 15, and deodorization processing of the stinkdamp which occurs by heating in a desulfurization process is carried out with this deodorization equipment 16. And a temperature control is carried out near the optimal desulfurization temperature of the vulcanized rubber which makes applicable to desulfurization a part of heating air generated in this deodorization processing, it uses as heating air required for desulfurization, and the remainder discharges smoke outside. } heat

[0004] Therefore, at the microwave heating process 15, since powder vulcanized rubber is heated with both microwave-energy - and the above-mentioned heating air, powder vulcanized rubber will be in a partial-solution polymerization state efficiently. And give frictional heating, and the rubber which changed into the partial-solution polymerization state makes it generate heat with the extruder equipped with the mechanical exoergic means 17 etc., and promotes depolymerization. Thus, it is fully plasticized and the desulfurized rubber is continuously emitted from the mechanical exoergic means 17.

[0005] Then, it is immediately cooled at the cooling process 18, and becomes the regenerated-rubber product 20 by refining with a mill etc. at the refining process 19. Since a lot of stinkdamp occurs while advancing plasticization by this mechanical exoergic means 17 and measuring desulfurization promotion, this stinkdamp is turned to combustion formula deodorization equipment 16 like the time of the microwave heating process 15, and deodorization processing is carried out.

[0006]

[Problem(s) to be Solved by the Invention] The regenerative apparatus of the above-mentioned conventional vulcanized rubber gives microwave-energy - and heating air simultaneously in the microwave heating process 15, and makes powder vulcanized rubber a partial-solution polymerization state promptly, and since give shear and frictional heat, they are made to generate heat and are made to depolymerize with the mechanical exoergic means 17 further, generation of heat is performed

*gas carrier*

effectively and efficiently. Moreover, since deodorization processing of a lot of stinkdamp which occurs in desulfurization process is carried out and a part of heating air which carried out deodorization processing is used as a source of heating, it is effective, and is pollution-free, and is a industrial very advantageous method.

[0007] However, it will become the high thing of cost while the regenerative apparatus for carrying out since the microwave heating process 15 and the mechanical exoergic means 17 are needed enlarges this regenerative apparatus.

[0008] this invention aims at development of the regenerative apparatus of abandonment vulcanized rubber advantageous to the industrial target which could carry out with the easy regenerative apparatus and was excellent in productive efficiency in view of the above-mentioned actual condition.

[0009]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, in the regenerative apparatus of the abandonment vulcanized rubber which heats the trituration object of abandonment vulcanized rubber to desulfurization temperature as the 1st invention in this invention by the screw extruder which established the mechanical exoergic means, and is reproduced, the regenerative apparatus of the abandonment vulcanized rubber carried out [ having had heating meanses, such as high-frequency induction heating which is made to carry out the temperature up of the vulcanized rubber, and carries out temperature maintenance from the outside of the above-mentioned mechanical exoergic means, and ] as the feature is proposed.

[0010] The regenerative apparatus of the abandonment vulcanized rubber characterized by considering desulfurization temperature of the above-mentioned vulcanized rubber as the composition which carries out adjustment control according to the ambient temperature or internal temperature of a mechanical exoergic means as the 2nd invention is proposed.

[0011] The regenerative apparatus of the abandonment vulcanized rubber characterized by considering desulfurization temperature of the above-mentioned vulcanized rubber as the composition which carries out adjustment control according to the temperature of the desulfurization rubber obtained by the above-mentioned mechanical exoergic means as the 3rd invention is proposed.

[0012] The regenerative apparatus of the abandonment vulcanized rubber characterized by considering as the composition which cools immediately the desulfurization rubber obtained with the above-mentioned mechanical exoergic means with a water cooler as the 4th invention is proposed.

[0013] The regenerative apparatus of the abandonment vulcanized rubber characterized by considering as the composition which cuts the desulfurization rubber obtained with the above-mentioned mechanical exoergic means to the length of a proper size with cutting equipment as the 5th invention is proposed.

[0014] The regenerative apparatus of the abandonment vulcanized rubber characterized by considering as the composition which deodorizes the stinkdamp which occurs by heating of the above-mentioned mechanical exoergic means with combustion formula deodorization equipment as the 6th invention is proposed.

[0015]

[Function] It is heating meanses, such as high-frequency induction heating, it is not necessary for the 1st invention not to put powder vulcanized rubber into the exoergic section of a mechanical exoergic means, and to make it heat and desulfurize it from the outside of a mechanical exoergic means and a mechanical exoergic means, and to establish the high microwave heating process of cost by this, and the regenerative apparatus to carry out will also become compact.

[0016] The 2nd invention is what was made to carry out adjustment control of the desulfurization temperature at the time of making powder vulcanized rubber desulfurize in a mechanical exoergic means with the ambient temperature or its internal temperature of this mechanical exoergic means, and thereby, powder vulcanized rubber is discharged from a mechanical exoergic means in the state of proper desulfurization, and it serves as a good regenerated-rubber product. [0017] Even if it carries out adjustment control and the 3rd invention constitutes the desulfurization temperature of powder vulcanized rubber in this way with the temperature of the rubber discharged from a mechanical exoergic means, the same effect as the 2nd invention of the above is acquired.

[0018] The regenerated rubber stabilized in order that the 4th invention may cool immediately the rubber discharged from a mechanical exoergic means with water and might prevent advance of a chemical reaction by this is obtained. Since generating of stinkdamp is moreover also suppressed extremely, it will become simple, and a deodorization means is also compact and serves as a regenerative apparatus excellent in the energy-saving effect.

[0019] Since the 5th invention cuts vulcanized rubber to suitable length, while its cooling effect improves, handling [ processes / back /, such as weighing capacity and refinement, ] of it becomes easy.

[0020] The 6th invention carries out deodorization processing of the stinkdamp which occurs by heating of a mechanical exoergic means by the combustion formula deodorization means, and serves as a regenerative apparatus which was excellent also from the field of pollution by this.

[0021]

[Example] Next, the example of this invention is explained along with a drawing. Drawing 1 is the block diagram showing the reproduction process of the regenerative apparatus concerning this invention, gives a same sign to the reproduction process of the conventional example, and a corresponding portion in explanation of this example, and omits the explanation.

[0022] Although the ground vulcanized rubber is based on the kind of rubber, it adds a rubber processing oil or a regenerant if needed, and is supplied to the screw-extrusion equipment 51 which was mixed at the preparation mixture process 14 and formed as a mechanical exoergic means. The vulcanized rubber which does not need this process is supplied to screw-extrusion equipment 51, ground.

[0023] It is heated until it desulfurizes with screw-extrusion equipment 51, and it is fully plasticized, and the supplied vulcanized rubber is discharged from extrusion equipment 51.

[0024] Moreover, combustion formula deodorization equipment 52 is connected with screw-extrusion equipment 51, and the stinkdamp which occurs by heating in a desulfurization process is deodorized with this deodorization equipment 52, and it emits to the open air. In addition, the raw gas after deodorization processing can be used as heat energy which returns and carries out remaining heat considerably for [ 14 ] high temperature (for example, a preparation mixture process).

[0025] Although the above-mentioned screw-extrusion equipment 51 is based also on the kind of rubber to process, it is possible to heat linearly to the temperature of 180 degrees C - ~~about 450 degrees C, to~~ carry out a depolymerization reaction for a short time, and to make it desulfurize. It is cooled at the cooling process 18 and let the desulfurized rubber be regenerated rubber 53 through the refining process 19 if needed after that.

[0026] Depending on the case, a chemical reaction can advance to \*\*\*\* with the heat with which rubber itself was filled, and cooling the rubber which carried out the temperature up and which was depolymerized to desulfurization temperature can cause self-generation of heat, it can prevent causing the carbonization or ignition by overheating, and obtaining stable regenerated rubber and generating of stinkdamp can be pressed down.

[0027] For this reason, at the cooling process 18, water performs rapid cooling for the rubber discharged from the mechanical exoergic means 51 immediately. The chemical reaction of rubber is stopped by this and suppression prevention also of the stinkdamp which occurs from rubber is carried out simultaneously.

[0028] Next, the screw-extrusion equipment 51 which contains cooling process 18 grade as a mechanical exoergic means for carrying out the regenerative apparatus of the abandonment vulcanized rubber by this invention is shown in drawing 2.

[0029] Screw-extrusion equipment 51 rotates the screw 55 which consisted of the transfer section 56 equipped with the screw 55 for a transfer in the cylinder 54, and the shear exoergic section 59 which connected with this transfer section 56 and was equipped with body of revolution 58 in the cylinder 57, and was described above by the motor 61 through a reducer 60.

[0030] Moreover, the feeder 62 which carries out constant-rate supply of the pulverization vulcanized rubber is attached in the cylinder 54 of the transfer section 56. Body of revolution 58 fixes to the point of the screw 55 which rushed in into the cylinder 57 of the shear exoergic section 59, and is rotated in

one with a screw 55.

[0031] This body of revolution 58 consists of the shear section 64 of a minor diameter a little from the bore of the compression zone 63 and cylinder 57 which were that the diameter of is expanded toward the direction of a nose of cam of the shear exoergic section 59, and much protruding line section 63a is formed in the front face of a compression zone 63 with the loose plagioscopic. Moreover, a part of periphery of the cylinder 57 of the shear exoergic section 59 and the thermo sensor 65 of a contacted type [ it is detailed and / near / the cylinder of the shear section 64 ] have fixed. Furthermore, this cylinder 57 is heated by the heating means from an outside.

[0032] As a heating means, it consists of high-frequency-induction-heating meanses 69 excellent in control responsibility, and although this is the means for which were most suitable, it can also be considered as the composition heated by the electric heater etc. in addition to this.

[0033] The nose of cam of the above-mentioned cylinder 57 serves as an exhaust port 66, and the rubber discharged from this exhaust port 66 is cooled with the water which blows off from the cooled nozzle 68 installed in the exhaust port covering 67. In addition, the stinkdamp which occurs at the time of discharge of rubber is led to deodorization equipment 52 with the duct prepared in some exhaust port coverings 67.

[0034] Pulverization rubber is continuously supplied in the transfer section 56 from the constant feeding machine 62, and is stuffed one by one into the direction of the shear exoergic section 59 by the rotating rotation of a screw 55. Although the vulcanized rubber pushed in in the shear exoergic section 59 is transported to an exhaust port 66 by work of body of revolution 58, vulcanized rubber generates heat rapidly with the frictional heat by rotation of a cylinder 57 and the shear section 64 between them.

[0035] Furthermore, since the cylinder 57 is heated to desulfurization temperature (180 degrees C - 450 degrees C) by the above-mentioned heating means 69, while being transported to an exhaust port 66 by delivery operation of body of revolution 58, the temperature up of the rubber it was [ rubber ] full of few gaps of a cylinder 57 and the shear section 64 is carried out to the desulfurization temperature efficiently defined by absorbing heat from the cylinder 57, and it causes a depolymerization reaction.

[0036] The heating means 69 heats a cylinder 57 at the temperature beforehand defined according to the kind of rubber, or the grade of desulfurization. Thereby, the rubber of the fully plasticized desulfurization state is continuously extruded according to the configuration of an exhaust port 66.

[0037] It is immediately cooled with the water which blows off from the cooled nozzle 68 installed in the exhaust port carver 67, and the desulfurization rubber extruded continuously is taken out by ejection conveyer 71. Furthermore, it passes through processes, such as ridge dryness, is refined and refined by the finishing roll machine, and becomes the regenerated-rubber product 53.

[0038] In addition, if the cutting equipments 70, such as a rotary cutter, cut simultaneously with cooling the desulfurization rubber extruded more nearly continuously than an exhaust port 66 in the size of fixed length, while the cooling effect will improve and physical properties will be stabilized more, there is an advantage from which the handling of back processes, such as weighing capacity and refinement, becomes easy. Cutting equipment 70 is driven in motor 70a.

[0039] The desulfurization temperature of vulcanized rubber is controlled by the rotational frequency of body of revolution 58, and temperature of the cylinder 57 of the shear exoergic section 59 in advancing plasticization in this mechanical exoergic means, and aiming at desulfurization promotion.

[0040] That is, the calorific value of vulcanized rubber is decided with length [ of the shear section 64 ] L, the rotational frequency of body of revolution 58, and the temperature of a cylinder 57. For example, if length L of the shear section 64 carries out the temperature up of the cylinder 57 to 400 degrees C and carries out the rotational frequency of body of revolution 58, i.e., a screw speed, as 90rpm by 50mm when the optimal desulfurization temperature is the vulcanized rubber which is 400 degrees C, as shown in drawing 3 with an example, the optimal desulfurization temperature will be reached in about 3 minutes. In addition, in Curve A, in drawing 3, a cylinder temperature and Curve B show rubber temperature.

[0041] Thus, it is detected by the temperature of a cylinder 57 whether the rubber to desulfurize is proper temperature (proper desulfurization) during desulfurization. That is, the temperature sensor 65

with which the cylinder 57 was equipped detects the temperature of a cylinder 57.

[0042] while controlling the power supply (not shown) of the heating means 69 automatically by this detecting signal and always holding the temperature of a cylinder 57 to predetermined temperature, the rotational frequency of a motor 61 is changed according to this detecting signal -- making -- the rotational frequency of body of revolution 58 -- controlling -- good -- rubber temperature is adjusted so that it may become \*\*\*\* reproduction conditions In addition, if signal processing is carried out in the comparison-operation section 72 and a rotational frequency is controlled automatically, the regenerated rubber stabilized more can be obtained.

[0043] Although this temperature sensor 65 measures the temperature of the peripheral face of a cylinder 57, you may make it measure the inner skin temperature of a cylinder 57, or the internal temperature of a cylinder 57.

[0044] A lot of gas occurs in the exhaust port covering 67 by the desulfurization rubber continuously discharged from an exhaust port 66. This stinkdamp is sent to deodorization equipment 52 through the jet pipe attached in some coverings 67 by the ventilating fan which is not illustrated.

[0045] Deodorization equipment 52 is the thing of well-known composition, and stinkdamp is directly contacted in the flame which burns at 500 degrees C or more (preferably 550-570 degrees C) of high temperature, and it burns it in an instant. As for the fuel for deodorization equipment 52, gas, such as a fuel oil, lamp oil, or LPG, LNG, is used.

[0046] Contact time can burn certainly the oil preferably contained in the range, then stinkdamp for 0.3-1 second, a hydrogen sulfide, nitrogen, chlorine, an aldehyde, etc., and can be decomposed. Thus, the heating air by which deodorization processing was carried out is emitted to the outdoors through a jet pipe.

[0047] The regenerative apparatus of the above-mentioned vulcanized rubber is controllable also by the temperature of the regenerated rubber extruded from the exhaust port 66 of the shear exoergic section 59, although the desulfurization temperature of vulcanized rubber is controlled by temperature of the cylinder 57 of the shear exoergic section 59.

[0048] In this case, the temperature of desulfurization rubber is directly measured by the contacted type temperature sensor 73 prepared inside the exhaust port 66 as contacted desulfurization rubber, signal processing of this measurement signal is carried out in the comparison-operation section 72, the rotational frequency of a motor 61 is changed, and rotation of body of revolution 58 is controlled automatically.

[0049] Thus, the rubber which was desulfurized in the shear exoergic section 59 and extruded from the exhaust port 66 is cooled with the water injected from the injection nozzle 68 prepared in the exhaust port covering 67 in order for oxidation reaction to advance with the heat of the rubber heated when it was left as it is and to cause pyrolysis, carbonization, or ignition by self-generation of heat.

[0050] Although based also on the kind of rubber, this oxidation reaction will hardly advance, if temperature is reduced to 150 degrees C - about 200 degrees C. Moreover, since all moisture will evaporate if the temperature after also cooling the water adhering to the rubber front face is 100 degrees C or more, desirable cooling temperature becomes 150 degrees C - 200 degrees C. The amount of water injected from an injection nozzle 68 and the number of nozzles, and the length of the rubber to cut can adjust this temperature.

[0051] Although the cooled desulfurization rubber is taken out by ejection conveyer 72, ridge and dryness are performed in this process.

[0052]

[Effect of the Invention] The regenerative apparatus of the abandonment vulcanized rubber concerning this invention as described above From heating from an outside the shear exoergic section prepared in the mechanical exoergic means, and carrying out the temperature up of the pulverization vulcanized rubber of the abandonment rubber supplied to this mechanical exoergic means to desulfurization temperature Conventionally, the vulcanized rubber which was being performed at a microwave heating process and both the processes of a mechanical exoergic means can be desulfurized, only by the mechanical exoergic means, it excels in productive efficiency and the microwave heating device of cost

quantity becomes unnecessary from a bird clapper with an economical regenerative apparatus.

---

[Translation done.]